Student poster presentation - AEG

A comparison of groundwater recharge estimation methods in the Williston and Powder River structural basins in the Northern Great Plains

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The water-table fluctuation (WTF) and chloride mass-balance (CMB) methods were used as a comparison to a numerical soil-water-balance (SWB) model to estimate groundwater recharge in the Williston and Powder River structural basins in the Northern Great Plains. Recharge was estimated for glacial deposits and exposed areas of the Lower Tertiary and Upper Cretaceous aquifer systems in the Dakotas, Montana, Wyoming, Saskatchewan, and Manitoba. The WTF and CMB methods were applied to local areas with available groundwater-level and chloride data. The SWB model consisted of 1 km^2 grid cells across the entire study area.

The WTF method uses easily accessible groundwater-level data to estimate groundwater recharge under the assumption that rises in unconfined groundwater levels are a result of recharge from precipitation. For this assumption to be valid, only recharge to unconfined aquifers can be estimated by this method. Recharge is then calculated by multiplying the specific yield of the aquifer by the change in water level. The CMB method determines the rate of recharge to an aquifer based on the chloride concentration in the groundwater and the rate of atmospheric chloride deposition. An assumption with this method is that all chloride in the aquifer is derived from atmospheric deposition, although other sources of chloride can be accounted for if known. Both the WTF and CMB methods inherently take into account mechanisms of flow through the unsaturated zone and are simple to apply. The SWB model is based on a modified Thornthwaite-Mather approach and is used to estimate recharge as infiltration below the root zone to each model cell on a daily time step. Inputs for the SWB model include daily precipitation and air temperature data, land-use classification, soil type, and surface-water flow direction for each model cell. The sources and sinks of water within each grid cell are determined by the SWB model on the basis of input data. Recharge is then calculated as the difference between the change in soil moisture and the flow rates of sources and sinks.